HAZARDOUS WASTE REMEDIATION IN CRITICAL WETLAND HABITAT: INTEGRATING GROUNDWATER, WETLAND, AND WATERSHED MODELS TO BRIDGE DIVERSE WATER MANAGEMENT NEEDS

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Pilot-scale research supporting groundwater remediation is being conducted at a grain storage facility near Utica, Nebraska. It has been proposed that groundwater withdrawn from a chlorinated methane plume beneath the grain storage facility be treated and discharged by spray irrigation to wetlands in the North Lake Basin Wildlife Management Area (WMA), an ecologically important rainwater basin. From a hazardous waste perspective, optimal rates and timing of groundwater pumping are constrained by plume hydrogeology and chemistry, treatment technology, and costs. However, the rainwater basins of Nebraska provide critical habitat for migratory waterfowl along the midcontinent flyway. From a wetland ecosystem perspective, optimal rates, timings and locations of groundwater discharges to the wetland depend on year-to-year climatic conditions and reflect a need to sustain or enhance existing wetland habitat.

An understanding of wetland hydrology is fundamental to the successful implementation of the proposed remediation plan. The hydrology of the North Lake Basin WMA is integrally linked with hydrologic conditions in the adjacent agricultural uplands, as well as hydrogeologic conditions of the underlying loess and alluvial deposits. Therefore, efforts to understand wetland hydrologic processes are being undertaken with the aid of integrated groundwater, wetland, and watershed models. Conceptual and numerical models have been developed that translate the wetland hydrologic structure into wetland hydrologic functions. Objective procedures for model application, coupled with limited water level monitoring, have been used to identify important hydrologic processes and to evaluate hydrologic conditions at the North Lake Basin WMA.

Current results indicate that the hydrologic impact of additional groundwater discharge to the wetland is minimal. Concern that addition of groundwater would cause flooding is not supported by hydrologic simulation except during years of extremely high precipitation. Historical data for years of high precipitation indicate that flooding has occurred even without increased groundwater discharge. Results of the work are being used to determine how spatial and temporal patterns in wetland hydrologic conditions are affected by variations in wetland water management strategies.

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